

What is the relationship between snacking and adiposity in children?

Conclusion

Limited and inconsistent evidence suggests that snacking is associated with increased body weight.

Grade: Limited

Overall strength of the available supporting evidence: Strong; Moderate; Limited; Expert Opinion Only; Grade not assignable For additional information regarding how to interpret grades [click here](#).

Evidence Summary Overview

The literature review identified six studies: five cohort studies (Bisset, 2007; Black, 2006; Field, 2004; Francis, 2003; Phillips, 2004) and one case-control study (Novaes, 2008). The studies were conducted in the US, Canada and Brazil. Studies ranged in sample size from 100 (Novaes, 2008) to 14,977 (Field, 2004) and three studies included only girls (Black, 2006; Francis, 2003; Phillips, 2004). Two studies found a positive relationship between snacking and body weight in children (Bisset, 2007; Novaes, 2008). Two studies found no relationship between snacking and body weight in children (Black, 2006; Phillips, 2004). One study initially found a negative relationship between snacking and adiposity in girls, but after adjusting for potential confounders the relationship was no longer significant (Field, 2004). One study only found that snacking in front of the television was associated with development of overweight in children (Francis, 2003). One of the reasons for the inconsistency of findings is likely due to the variability in the design of studies and definitions for snacking.

Evidence summary paragraphs:

Cohort Studies (5)

Bisset S et al, 2007 (positive quality) analyzed prospective cohort data from Canada to examine whether low-quality snacking is associated with the occurrence of overweight and obesity in mid-adolescence. Data was from the Quebec Heart Health Demonstration Project. Baseline data were collected in 1995, and subjects were followed-up five years later. Eating behavior was measured using a self-administered food frequency questionnaire (FFQ) at baseline and five years. Body mass index (BMI) was calculated using self-reported height and weight only at the five-year follow-up. The final sample included 1,188 participants who provided data on at least one occasion (627 boys, 561 girls; in grade nine, 12.4% were overweight and 7.3% were obese). Students reported consuming low-quality snacks an average of 10 times a week over five years, with the consumption of these snacks increasing over time ($P < 0.0001$). Body mass index was associated with changes in the frequency of low-quality snacking over time $[-0.31 (0.14), T = -2.22; P < 0.05]$, such that while snacking increased in the sample over time, low-quality snacking remained relatively stable in obese subjects. The authors concluded that obesity was associated with more stable low-quality snacking over time.

Black MM et al, 2006 (positive quality) used prospective cohort data from the United States to determine whether dietary patterns are associated with body size in adolescent African-American

mothers one year after delivery and with changes in body size over the next year. Height and weight were measured one and two years after delivery, and BMI and BMI Z-scores were calculated. Dietary patterns were measured with the Youth Adolescent FFQ, a 131-item survey, including items considered to be snacks or desserts. The final sample included 118 girls (mean age = 16 years at delivery; one year after delivery 33% were overweight, 24% were at risk of overweight and 43% were normal weight or underweight). One year after delivery, normal- and underweight subjects consumed 4.4 ± 3.7 snack and dessert servings a day, at risk of overweight subjects consumed 4.0 ± 4.8 snack and dessert servings a day and overweight subjects consumed 3.8 ± 2.6 snack and dessert servings a day. After adjusting for maternal age, education, intervention status and breastfeeding history, there was no association between consumption of snacks and desserts and change in BMI Z-score between the one- and two-year visits. The authors concluded that subjects in this study had high rates of snack consumption, and though not associated with change in BMI over one year, could benefit from consuming healthier snack alternatives.

Field AE et al, 2004 (neutral quality) conducted a prospective cohort study and examined whether intake of snack foods was associated with weight change among children and adolescents. Subjects were part of the Growing Up Today Study, and were nine to 14 years of age at baseline in 1996, and were followed until 1999. Intake of snack foods was assessed in 1996 to 1998 using a validated FFQ. Height and weight were self-reported annually from 1996 to 1999, and used to calculate BMI and BMI Z-scores. The final sample included 14,977 subjects (8,203 girls, 6,774 boys; mean age at baseline = 12 years; mean BMI at baseline = 19 kg/m^2). After controlling for Tanner stage of development, age, height change, activity and inactivity, there was no relation between intake of snack foods and subsequent changes in BMI Z-score among the boys, but snack foods had a weak inverse association ($\beta = -0.007$, $P < 0.05$) with weight change in girls. However, after controlling for dieting status and maternal weight status, the association was no longer significant. The authors concluded that snack foods were not an independent determinant of weight gain among children and adolescents.

Francis LA et al, 2003 (positive quality) analyzed prospective cohort data to examine whether TV viewing provides a context for patterns of snacking fostering overweight in young girls. Subjects were non-Hispanic white girls from central Pennsylvania who were assessed longitudinally when they were five, seven and nine years old. Dietary intake was assessed using three 24-hour dietary recalls when girls were five, seven and nine years old. Girls' height and weight were measured at ages five, seven and nine years, and BMI was calculated. TV viewing was assessed when girls were seven and nine years old, and girls' snacking while watching TV was measured at age nine years. The final sample included 173 girls (mean BMI at age five and seven = 16 kg/m^2 , mean BMI at age nine = 18 kg/m^2). Girls who watched TV snacked more frequently ($P < 0.05$) and girls who snacked more frequently had higher intake of fat from energy-dense snacks ($P < 0.05$), which predicted their increase in BMI from age five to nine ($P < 0.05$). The authors concluded that snacking in front of the TV is a risk factor for the development of overweight in children.


Phillips SM et al, 2004 (positive quality) used data from a prospective cohort study to examine the relationship between the consumption of energy-dense snack foods and relative weight change during adolescence. Subjects were from the Massachusetts Institute of Technology Growth and Development Study, who were enrolled between 1990 and 1993 and followed until four years after menarche. During each annual follow-up visit, dietary intake was assessed using a FFQ, and height and weight was measured to calculate BMI and BMI Z-scores. The final sample included 178 girls (mean age at baseline = 10 years; mean BMI at baseline = 17 kg/m^2). At baseline, girls consumed 2.3 servings a day of energy-dense snack foods, with 16% of daily calories coming from these snack foods. There was no relationship between BMI Z-score and total energy-dense snack consumption. The authors concluded that in this cohort of initially non-obese girls, overall




energy-dense snack food consumption did not influence weight change over adolescence.



Case-Control Study (1)

Novaes JF et al, 2008 (neutral quality) conducted a case-control study to identify risk factors for obesity in children from Brazil. Subjects were normal weight or obese, and paired according to gender, age and socioeconomic condition. A questionnaire was used to assess feeding habits, and weight and height was measured by study personnel to calculate BMI. The final sample included 100 children (50 normal weight, 50 obese; ages six to eight years). Frequent snack consumption from commercial establishments was significantly associated with obesity (OR 70.49, 95% CI: 2.17 to 182.74, P=0.0159). The authors concluded that increased snack food consumption among children greater risk of obesity.

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Author, Year, Study Design, Class, Rating	Participants	Methods	Outcomes
<p>Bisset et al 2007</p> <p>Study Design: Prospective cohort study</p> <p>Class: B</p> <p>Rating: </p>	<p>N=1,188 participants who provided data on at least one occasion (627 boys, 561 girls).</p> <p>Age: Grade nine.</p> <p>12.4% overweight; 7.3% obese.</p> <p>Location: Canada.</p>	<p>Data were from the Quebec Heart Health Demonstration Project. Baseline data was collected in 1995, and subjects were followed-up five years later.</p> <p>Eating behavior was measured using a self-administered FFQ at baseline and five years.</p> <p>BMI was calculated using self-reported height and weight only at the five-year follow-up.</p>	<p>Students reported consuming low-quality snacks an average of 10 times a week over five years, with the consumption of these snacks ↑ over time (P<0.0001).</p> <p>BMI was associated with Δs in the frequency of low-quality snacking over time [-0.31 (0.14), T=-2.22; P<0.05], such that while snacking ↑ in the sample over time, low-quality snacking remained relatively stable in obese subjects.</p>
<p>Black et al 2006</p> <p>Study Design: Prospective cohort study and cross-sectional</p>	<p>N=118 post-partum girls.</p> <p>Mean age: 16 years at delivery.</p> <p>One year after</p>	<p>Height and weight were measured one and two years after delivery, and BMI and BMI Z-scores were calculated.</p> <p>Dietary patterns were</p>	<p>One year after delivery, normal- and underweight subjects consumed 4.4±3.7 snack and dessert servings a day, at risk of overweight subjects consumed 4.0±4.8 snack and dessert servings a</p>


<p>Cross-sectional study</p> <p>Class: B</p> <p>Rating: </p>	<p>delivery 55% were overweight, 24% were at risk of overweight and 43% were normal weight or underweight.</p> <p>Location: United States.</p>	<p>measured with the Youth Adolescent FFQ, a 131-item survey, including items considered to be snacks or desserts.</p>	<p>snack and dessert servings a day, and overweight subjects consumed 3.8 ± 2.6 snack and dessert servings a day.</p> <p>After adjusting for maternal age, education, intervention status and breastfeeding history, there was no association between consumption of snacks and desserts and Δ in BMI Z-score between the one- and two-year visits.</p>
<p>Field et al 2004</p> <p>Study Design: prospective cohort study</p> <p>Class: B</p> <p>Rating: </p>	<p>N=14,977 subjects (8,203 girls, 6,774 boys).</p> <p>Mean age at baseline: 12 years.</p> <p>Mean BMI at baseline = 19 kg/m^2.</p> <p>Location: United States.</p>	<p>Subjects were part of the Growing Up Today Study, and were nine to 14 years of age at baseline in 1996, and were followed until 1999.</p> <p>Intake of snack foods was assessed in 1996 to 1998 using a validated FFQ.</p> <p>Height and weight were self-reported annually from 1996 to 1999, and used to calculate BMI and BMI Z-scores.</p>	<p>After controlling for Tanner stage of development, age, height Δ, activity and inactivity, there was no relation between intake of snack foods and subsequent Δs in BMI Z-score among the boys, but snack foods had a weak inverse association ($\beta = -0.007$, $P < 0.05$) with weight Δ in girls. However, after controlling for dieting status and maternal weight status, the association was no longer significant.</p>
<p>Francis LA, Lee Y, Birch LL 2003</p> <p>Study Design: cohort study</p> <p>Class: B</p> <p>Rating: </p>	<p>N=173 girls.</p> <p>Mean BMI at age five and seven: 16 kg/m^2.</p> <p>Mean BMI at age nine: 18 kg/m^2.</p> <p>Location: United States.</p>	<p>Subjects were non-Hispanic white girls from central Pennsylvania, who were assessed longitudinally when they were five, seven and nine years old.</p> <p>Dietary intake was assessed using three 24-hour dietary recalls when girls were five, seven and nine years</p>	<p>Girls who watched TV snacked more frequently ($P < 0.05$) and girls who snacked more frequently had higher intake of fat from energy-dense snacks ($P < 0.05$), which predicted their \uparrow in BMI from age five to nine years ($P < 0.05$).</p>


		<p>old.</p> <p>Girls' height and weight were measured at ages five, seven and nine years, and BMI was calculated.</p> <p>TV viewing was assessed when girls were seven and nine years old, and girls' snacking while watching TV was measured at age nine years.</p>	
<p>Novaes JF, Franceschini SC et al, 2008</p> <p>Study Design: Case Control Study</p> <p>Class: C</p> <p>Rating: </p>	<p>N=100 children.</p> <p>50 normal weight, 50 obese.</p> <p>Age: Six to eight years.</p> <p>Location: Brazil.</p>	<p>Subjects were normal weight or obese, and paired according to gender, age and socioeconomic condition.</p> <p>A questionnaire was used to assess feeding habits, and weight and height was measured by study personnel to calculate BMI.</p>	<p>Frequent snack consumption from commercial establishments was significantly associated with obesity (OR 70.49, 95% CI: 2.17 to 182.74, P=0.0159).</p>
<p>Phillips SM, Bandini LG et al, 2004</p> <p>Study Design: Cohort study (longitudinal, prospective)</p> <p>Class: B</p> <p>Rating: </p>	<p>N=178 girls.</p> <p>Mean age at baseline: 10 years</p> <p>Mean BMI at baseline = 17kg/m².</p> <p>Location: United States.</p>	<p>Subjects were from the Massachusetts Institute of Technology Growth and Development Study, who were enrolled between 1990 and 1993 and followed until four years after menarche.</p> <p>During each annual follow-up visit, dietary intake was assessed using a FFQ, and height and weight was measured to calculated</p>	<p>At baseline, girls consumed 2.3 servings a day of energy-dense snacks foods, with 16% of daily calories coming from these snack foods.</p> <p>There was no relationship between BMI Z-score and total energy-dense snack consumption.</p>


Research Design and Implementation Rating Summary

For a summary of the Research Design and Implementation Rating results, [click here](#).


Worksheets


 [Bisset S, Gauvin L, Potvin L, Paradis G. Association of body mass index and dietary restraint with changes in eating behaviour throughout late childhood and early adolescence: a 5-year study. *Public Health Nutrition*. 2007;10\(8\):780-789.](#)

 [Black, Maureen M., et al Overweight Adolescent African-American Mothers Gain Weight in Spite of Intentions to Lose Weight *JADA* 106:1: 80-87 2006](#)

 [Field AE, Austin SB, Gillman MW, Rosner B, Rockett HR, Colditz GA. Snack food intake does not predict weight change among children and adolescents. *Internatl J Obes Relat Metab Disord*. 2004; 28: 1210-1216.](#)

 [Francis LA, Lee Y, Birch LL. Parental weight status and girls' television viewing, snacking, and body mass indexes. *Obes Res* 2003;11:143-51.](#)

 [Novaes JF, Franceschini Sdo C, Priore SE. Mother's overweight, parents' constant limitation on the foods and frequent snack as risk factors for obesity among children in Brazil. *Arch Latinoam Nutr*. 2008 Sep; 58 \(3\): 256-264.](#)

 [Phillips SM, Bandini LG, Naumova EN, Cyr H, Colclough S, Dietz WH, Must A. Energy-dense snack food intake in adolescence: longitudinal relationship to weight and fatness. *Obes Res*. 2004;12:461-472.](#)